RESEARCH DEPARTMENT

THE NEUMANN ELECTROSTATIC MICROPHONE TYPE KM.54

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W. I. Manson, B.Sc. (Eng.)
J. Nash

T. Somerville
(T. Somerville)

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PRIVATE AND CONFIDENTIAL

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SUMMARY

The Neumann KM.54 is a small electrostatic microphone with nominally cardioid characteristics. Tests were carried out on a single specimen and the results of measurements of frequency response, sensitivity, noise level and susceptibility to magnetic fields are given in this report.

1. INTRODUCTION.

The KM.54 microphone is manufactured by the firm Georg Neumann in Berlin; the price to the Corporation in 1955 was £111.

Fig. 1 shows an external view of the microphone head and Fig. 2 the head with the outer case removed. The capsule has a single diaphragm of nickel, 5 microns thick, and is designed to produce a cardioid directivity pattern. The KM.54 is similar in essentials to the Hiller M.59 microphone described in Research Department Report M.025 but differs from it in two respects. The M.59 has an external baffle which increases the effective path length between front and rear of the diaphragm; this feature is absent from the KM.54 and it is evident that the resultant force acting on the diaphragm must be less. Further, the pre-amplifier of the KM.54 microphone, unlike that of the M.59, is contained entirely in the microphone head.

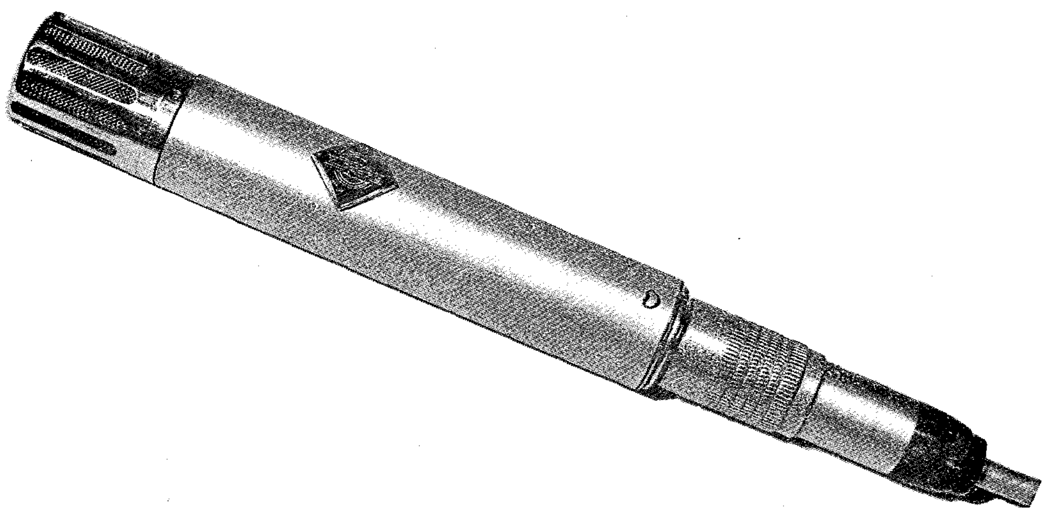


Fig. 1 - Microphone Head. External View

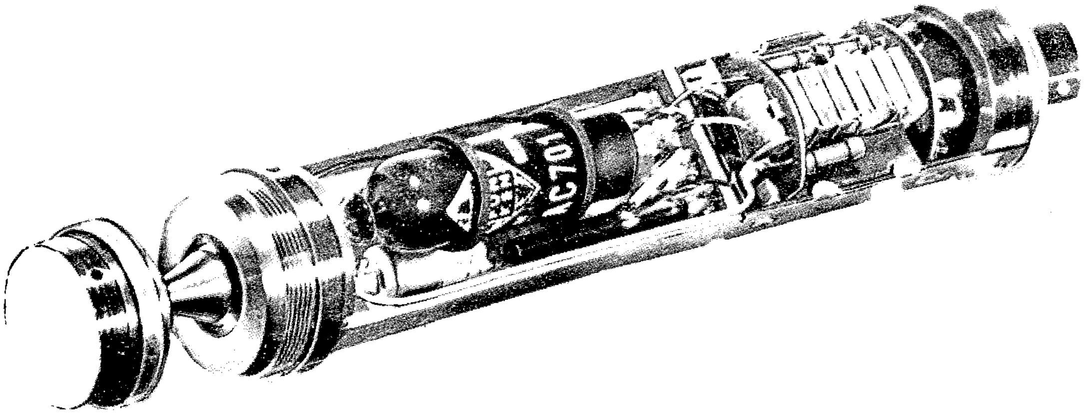


Fig. 2 - Microphone Head. Case removed

Fig. 3 shows the circuits of the KM.54 pre-amplifier and of the associated mains unit, which is connected to the microphone head by a multicored cable 10 m in length.. A shield, type Z.18, is provided as a protection against wind, draughts or breath and is fitted when the microphone is used for close talking. This shield, which is shown in Fig. 4, is in the form of a spherical shell some 5·5 cm in diameter consisting of two layers of open wire mesh supporting between them a layer of a very fine wire gauze.

The nominal output impedance of the microphone is 200 ohms but provision is made for obtaining a 50 ohm output by changing connections on the output transformer.

A more detailed description of the microphone has been given in the technical press*.

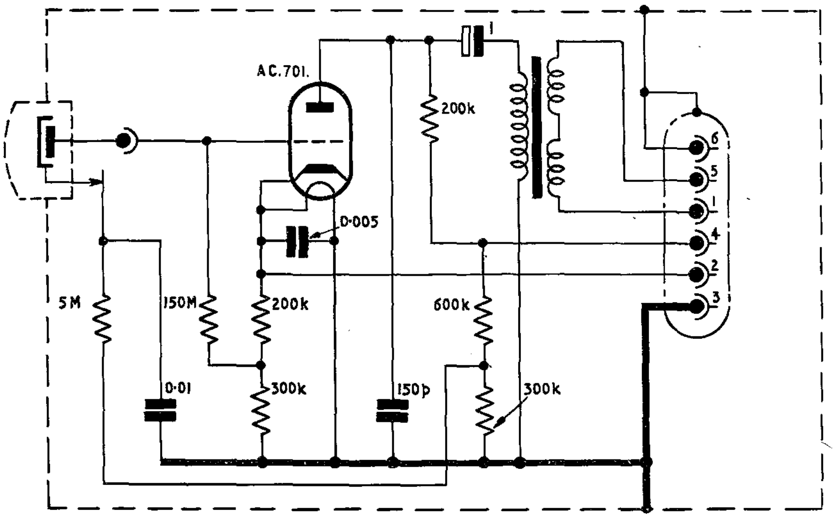
2. DIMENSIONS AND WEIGHTS.

Microphone Head.	Dimensions:	13 cm x 2·1 cm diameter
	Weight:	110 g approximately
Shield.	Dimensions:	5·5 cm diameter
	Weight:	130 g
Power Unit.	Dimensions:	22 cm x 10 cm x 12 cm approximately
	Weight:	2·4 kg

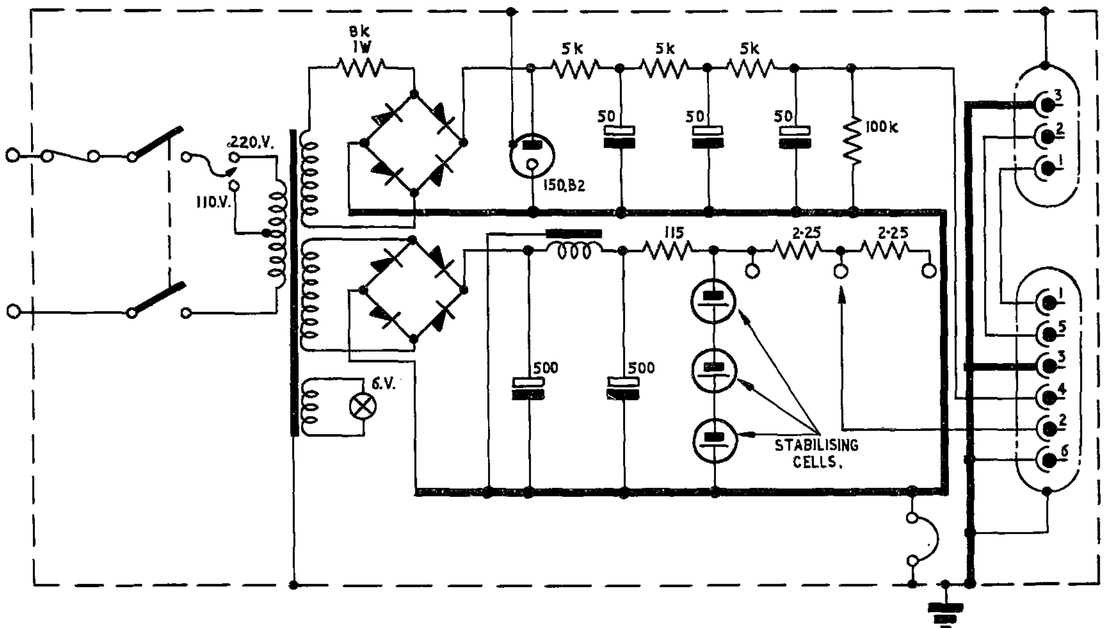
3. FREQUENCY CHARACTERISTICS.

Fig. 5 shows the open-circuit frequency characteristics of the microphone for sound incident at various angles. The response falls markedly at low frequencies and rises to a maximum at approximately 8 kc/s. The difference between the front and

* H. Heyer, H. Wallow. "Kondensator-Kleinmikrofone". Radio Mentor. No. 10. 1954.



(a).



(b).

Fig. 3 - Circuit diagram
(a) Microphone head amplifier
(b) Power supply unit

back response is some 19 dB at 1 kc/s but falls to about 11 dB below 100 c/s and in the 9 kc/s to 10 kc/s region. The response at 90° is approximately 5 dB below that on the axis at 1 kc/s but this difference is reduced to about 4 dB below 100 c/s and to about 2 dB in the 9 kc/s to 10 kc/s region.

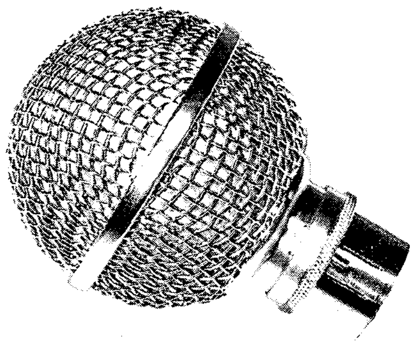


Fig. 4 - Shield

Fig. 6 shows the corresponding curves obtained with the shield in place. It will be seen that at low frequencies the microphone becomes omnidirectional and that the axial response is reduced by a further 4½ dB at 50 c/s. It may be noted, however, that, as the directivity index of a cardioid microphone is 5 dB, the random-incidence response at low frequencies is substantially unchanged.

Fig. 7(a) shows the relationship between open-circuit voltage and the voltage developed across a 300 ohm load. The frequency response of the microphone with this load is substantially the same as for the open-circuit condition.

Fig. 7(b) shows the modulus of the microphone impedance. This impedance is nearly constant over the working frequency range.

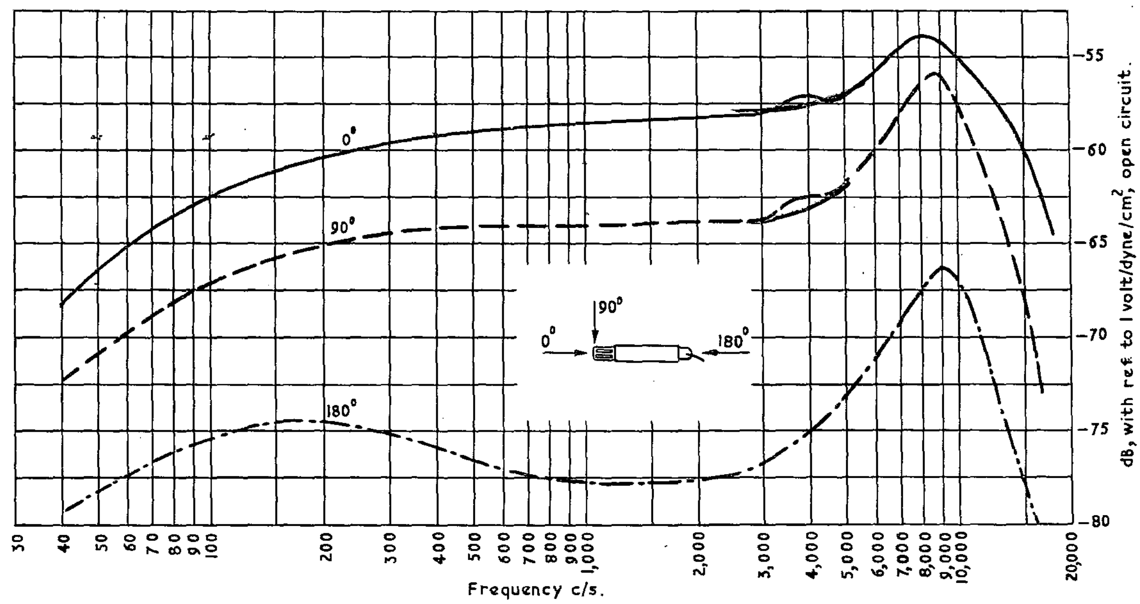


Fig. 5 - Open-circuit frequency characteristics for sound incident at various angles. Without shield

Fig. 8 shows the frequency response curve and tolerance band published by the manufacturers, replotted to the same scale as Figs. 5 and 6. The principal discrepancies are at low frequencies and are probably attributable to the erroneous practice, common in Germany, of testing all microphones at a short distance from a small sound source.

4. SENSITIVITY.

The open-circuit mid-band sensitivity is approximately −58 dB with reference

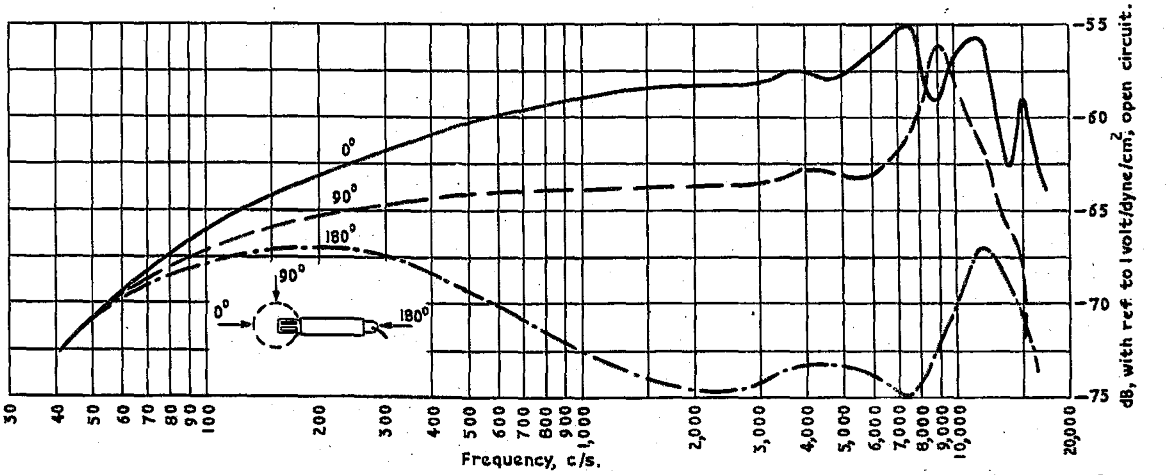


Fig. 6 - Open-circuit frequency characteristics for sound incident at various angles. With shield

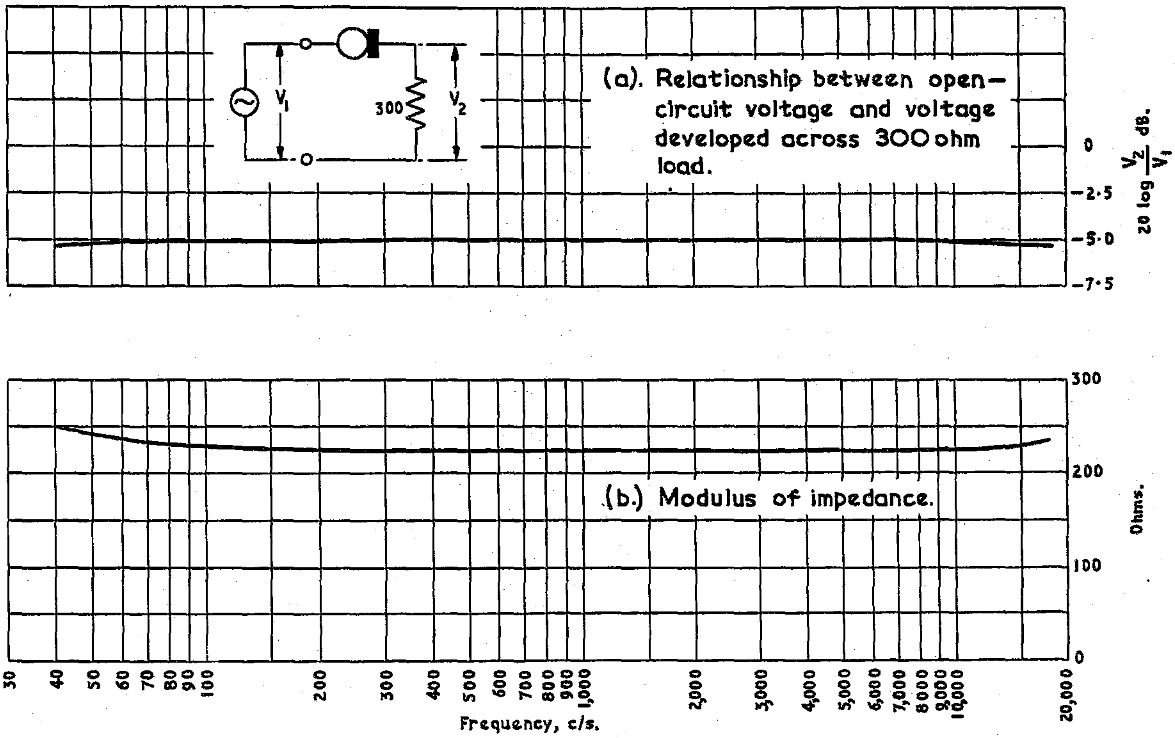


Fig. 7

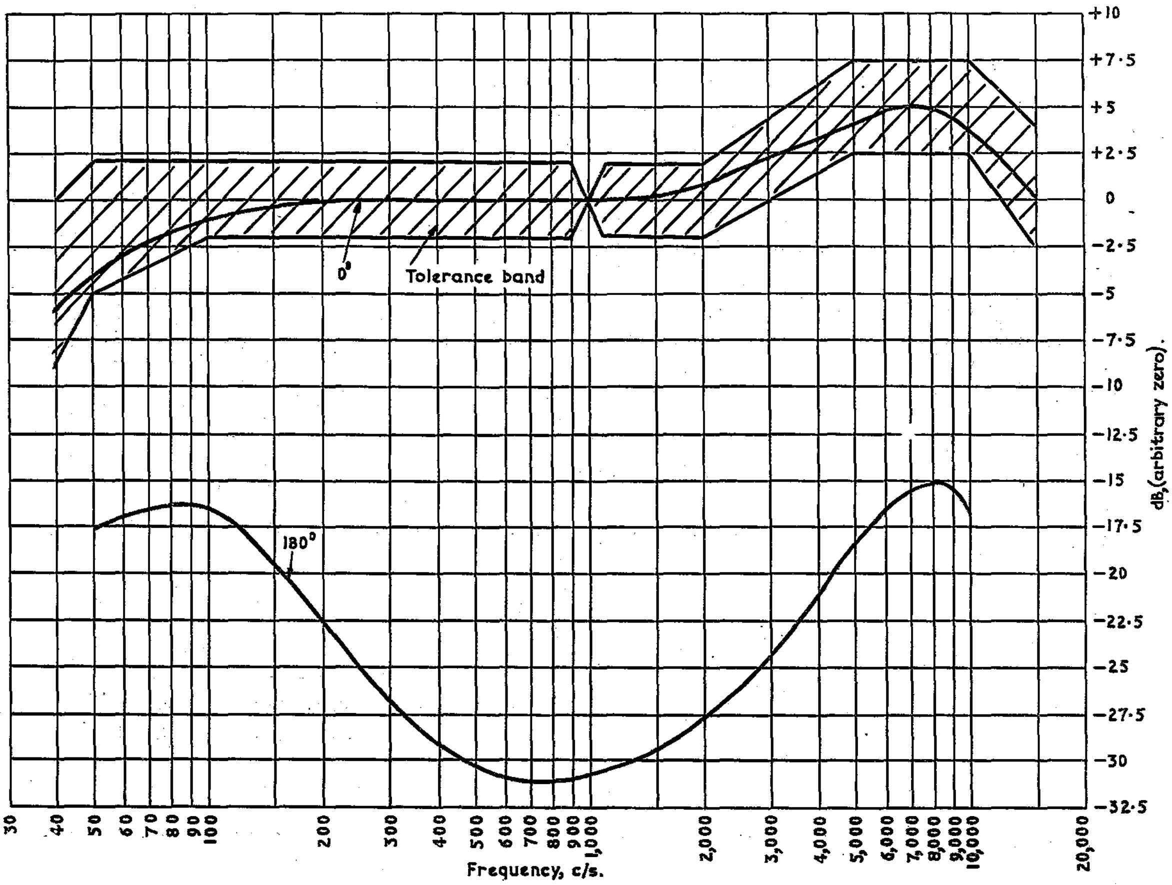


Fig. 8 - Frequency characteristics given by manufacturers

to 1 volt/dyne/cm² for sound at axial incidence. This figure is reduced to −59 dB when the shield is fitted. At the output of an ideal 200 ohm/300 ohm transformer the sensitivities would be −56 dB and −57 dB respectively.

The sensitivity figure given by the manufacturers is −58 dB with reference to 1 volt/dyne/cm².

5. NOISE.

The weighted open-circuit noise level from the microphone is −105 dB with reference to 1 volt. The sound level in the mid-band region which at axial incidence would produce an equal output voltage is +27 dB with reference to 0·0002 dyne/cm².

6. INTERFERENCE FROM MAGNETIC FIELDS.

The susceptibility to interference from magnetic fields, both of the microphone head and of the power supply unit, was measured at 50 c/s, 1 kc/s and 10 kc/s and found to be extremely low. In no case did the output exceed −114 dB relative to 1 volt when the apparatus was subjected to a uniform magnetic field of 1 milligauss. This output is equal to that produced by a sound at 1 kc/s having a level of +18 dB with reference to 0·0002 dyne/cm².

7. CONCLUSION.

The salient feature in the performance of the KM.54 microphone is the considerable fall in response at low frequencies, an effect which is aggravated when the shield is used. The directional properties of the microphone are fairly well maintained over the frequency range but are seriously degraded at low frequencies by the presence of the shield. The noise level is rather higher than in the corresponding Hiller type M.59; the differences may be attributed to the relatively short front-to-back path of the KM.54 capsule. In contrast to the M.59 the KM.54 offers the advantage of a balanced output from the microphone head and an output impedance nearly independent of frequency.

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